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Note accompanying Drawings of Jupiter, Mars, &c.
By Wm. Huggins, Esq.

"I send herewith two drawings of *Jupiter* for Oct. 14th and 15th. On each occasion the planet was watched for a considerable time, but no change of appearance or of relative position was observed in the markings on the belts, except that due to *Jupiter's* rotation.

"Also, two drawings of the planet *Mars* for April 28th and May 19th.

"Also, a coloured drawing of the lunar eclipse of Oct. 13th, 1856, to show the *deep blue* colour of the *edge* of the umbra, which, for a short time before and after the greatest observation, was in strong contrast with the copper colour of the remainder of the Moon's surface. Gleams of silver-grey light were noticed from time to time to light up partially the dark-blue edge of the umbra. They appeared as if thrown very obliquely upon the Moon from the east.

"*Upper Tulse Hill.*"

On Variable Stars. By Norman Pogson, Esq.

(*Communicated by the President.*)

The ready response which the proposal for a division of labour in the case of observations of the small planets has recently met with, induces me to hope that a similar arrangement may be made with equal facility for the variable stars. Little is yet known of many of these curious objects, in consequence of the small number of observers who have devoted their time to the subject, and it is only by continuous observations that we can expect to trace to fixed laws the often capricious changes which some of these bodies undergo. To facilitate such observations during the ensuing year, I have deduced, from the best available sources, the most probable times of maxima of most of the long-period variables, also the conveniently observable minima of six short-period stars. I have been obliged to omit many of the former class, and even the well-known variable β *Lyræ*, for want of trustworthy elements on which to base their ephemerides. Most of the minima of S *Cancri* in 1857 will, unfortunately, occur at very inconvenient hours. I am indebted to Joseph Baxendell, Esq., of Manchester, for the periods and epochs of the two variables discovered by him, viz. λ *Tauri* and 13 *Lyræ*.

Professors Argelander and Heis, Dr. Schoenfeld, and M. Schmidt, appear to have occupied themselves mostly with the older variables, especially with ο *Ceti*, *Algol*, ε *Aurigæ*, ζ *Gemi-*

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norum, S *Cancri*, R *Virginis*, α *Herculis*, β *Lyræ*, χ *Cygni*, and δ *Cephei*. Some time since Professor Oudemans signified his intention of watching the telescopic variables discovered by Mr. Hind. Doubtless he will also take care of his own recent discovery, S *Tauri*, as Dr. Luther has hitherto done of his S *Piscium*. Mr. Baxendell has authorised me to state that he has for some years past observed, and will in future hold himself responsible for observations of λ *Tauri*, α *Herculis*, β *Lyræ*, 13 *Lyræ*, χ *Cygni*, η *Aquilæ*, Herschel's *Garnet Star*, and δ *Cephei*. Lastly, I have adopted as my own charge R, S, T, and U *Geminorum*, R *Leonis*, R and S *Ursæ Majoris*, S *Virginis*, S and R *Ophiuchi*, R *Cygni*, 24 *Cephei* (*Hev.*), and R *Cassiopeiæ*.

While writing upon the subject, I take the opportunity to make the following general remarks:—Very few of the variable stars increase and decrease with equal rapidity; hence the time of maximum cannot be deduced by taking the mean between two dates of equal brightness before and after such maximum. I find the most simple and expeditious method to be that of projection on cross-ruled paper, making the abscissæ represent days, and the ordinates magnitudes, to tenths. A curve traced through observations thus projected gives the best general idea of the march of variation, and of any flexures which may occur in the increase or decrease. With the exception of β *Lyræ*, most of the short-period variable stars are tolerably regular, and vary more rapidly about minimum than near maximum. One star, U *Geminorum*, discovered by Mr. Hind in Dec. 1855, is exceedingly curious. For upwards of 90 days it remains invisible,—increases to maximum (9th mag.) and again disappears in about a fortnight, and a day or two after maximum shows remarkable unsteadiness or twinkling which I have not observed with other variables. Next to U, perhaps S *Geminorum* is the most rapid in its visible changes, and remains invisible for the greatest fraction of its period. Its neighbour, T *Geminorum*, is much slower in its changes, though its whole period is a few days shorter than that of S. R and S *Ursæ Majoris* are remarkably regular as regards time of maximum, though less so in intensity of light. R rises with astonishing rapidity to maximum, but fades away very slowly, while S is the most equal in duration of increase and decrease of any variable I know. Others again are very irregular, especially ο *Ceti*, R *Leonis*, S *Virginis*, R *Coronæ*, α *Herculis*, R *Scuti*, and R *Cassiopeiæ*. The star 24 *Cephei* (*Hev.*), if periodical, cannot complete its changes in less than 73 years, which makes it due as a naked-eye star about 1880. It has certainly increased during the last 7 years. The red, or rather scarlet tint, is very decided in many stars at maximum. I have noticed it chiefly in R *Cassiopeiæ*, R *Leonis*, and S *Virginis*, which are all irregular stars: in others, as R *Ursæ Majoris*, R *Cygni*, and U *Geminorum*, no change of colour has been perceived. Some stars which do not disappear are hazy and indistinct at minimum, as if surrounded by a corona, or seen out of focus; others are sharp and point-like at such time. So various

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are the appearances presented by these mysterious stars, for whose changes no plausible hypothesis has ever yet been suggested.

Variable Star Maxima in the Year 1857.

Star.	Probable Mag.	Mean Place in 1860.		Date of Maxima.
		R. A.	N. P. D.	
		h m s	° ′	
T Piscium	9·5	0 24 46	76 20	About the end of July or beginning of Aug.
α Cassiopeiæ....	2	0 32 35	34 14	Jan. 9, Mar. 29, June 16, Sept. 3, Nov. 21.
R Piscium	7·5	1 23 25	87 50	Early in June.
ο Ceti..........	2·3	2 12 17	93 37	1856, Dec. 30; 1857, Nov. 30.
R Tauri........	8	4 20 38	80 9	1856, Dec. 20; 1857, Nov. 10.
R Orionis	9	4 51 22	82 5	Either Jan. 31, or April 23. (Period still uncertain.)
ε Aurigæ	3·5	4 51 56	46 23	Feb. 14; Oct. 22.
α Orionis	1	5 47 36	82 37	Early in April, and about middle of October.
R Geminorum ..	7	6 58 56	67 5	Jan. 2; and 1858, Jan. 7.
R Canis Minoris	8	7 1 0	79 45	April or May.
S Geminorum ...	9	7 34 38	66 14	Jan. 5, and Oct. 27.
T Geminorum ...	9	7 40 54	65 55	Aug. 5.
U Geminorum...	9·3	7 46 48	67 38	March 4, and October 15. Only visible for about a fortnight.
R Cancri	6	8 8 57	77 53	February or March.
S Hydræ.......	8·5	8 46 15	86 24	March 19, and Dec. 4.
T Hydræ.......	6·5	8 48 51	98 37	January and September.
R Leonis.......	5	9 40 2	77 55	Near the end of July, and therefore not observable.
R Ursæ Majoris	7·5	10 34 41	20 29	May 14. (Minima, Jan. 19, and Nov. 17.)
R Virginis......	6·5	12 31 24	82 14	March 25, and Aug. 17.
S Ursæ Majoris	7	12 37 48	28 8	April 20, and Nov. 28. (Minima, Jan. 11, and Aug. 20.)
R Hydræ.......	4	13 22 5	112 33	Possibly early in February, but uncertain.
S Virginis	5·5	13 25 42	96 28	March 29. Changes of colour very decided.
S Serpentis	8	15 15 8	75 11	June 26.
R Coronæ	6	15 42 49	61 25	Very uncertain, but perhaps in May.
R Serpentis.....	6·5	15 44 15	74 26	Nov. 8, and therefore not observable.
S Ophiuchi	9·3	16 26 12	106 53	May 15.
R Ophiuchi.....	8	16 59 44	105 54	October 4.
α Herculis......	3	17 8 16	75 27	April 14, June 19, August 24, and Oct. 30. Very irregular.
R Scuti	5	18 40 1	95 50	April 18, June 29, and Sept. 8. Also very irregular.
13 Lyræ	4·3	18 51 4	46 14	Jan. 8, Feb. 23, Apr. 11, May 28, July 13, Aug. 29, Oct. 15, and Nov. 30.
R Aquilæ	6·5	18 59 40	81 59	Probably early in August.
R Cygni	8	19 33 4	40 7	Feb. 14. (Minimum, Oct. 23.)
χ Cygni........	5	19 41 7	56 36	December 27.
R Pegasi	8·5	22 59 38	80 13	August 15.
R Aquarii	7	23 37 15	106 3	July 27.
R Cassiop. (2nd)	6	23 51 18	39 23	1858, Jan. 30. (Minimum, 1857, Aug. 21.)

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Minima of Short-period Variable Stars in the year 1857, for the Earth's Mean Distance from each Star, and Greenwich Mean Times.

Algol.
Max. 2·3. Min. 4·0.

		h	m
Jan.	2	9	28
	5	6	17
	19	14	21
	22	11	10
	25	7	59
Feb.	11	12	52
	14	9	41
March	6	11	23
	9	8	12
	29	9	54
April	21	8	25
May	28	15	0
June	20	13	31
July	13	12	2
Aug.	2	13	44
	5	10	33
	25	12	15
	28	9	4
Sept.	14	13	57
	17	10	46
	20	7	35
Oct.	7	12	28
	10	9	17
	27	14	10
	30	10	59
Nov.	2	7	48
	19	12	41
	22	9	30
	25	6	19
Dec.	9	14	23
	12	11	12
	15	8	1

λ Tauri.
Max. 4·0. Min. 4·5.

		h	m
Feb.	4	12	37
	8	11	29
	12	10	21
	16	9	13
	20	8	5
Oct.	7	14	9
	11	13	1
	15	11	53
	19	10	44
	23	9	36
	27	8	28
	31	7	20

δ Cephei.
Max. 3·7. Min. 4·8.

		h	m
Jan.	15	14	5
	26	7	40
Feb.	11	10	3
	27	12	26
Mar.	15	14	49
	26	8	24
April	11	10	47
	27	13	10
May	24	9	9
June	9	11	32
	25	13	55
July	22	9	53
Aug.	7	12	16
	23	14	39
Sept.	19	10	37
Oct.	5	13	0
Nov.	1	8	59
	17	11	22
Dec.	3	13	45
	14	7	20
	30	9	43

η Aquilæ.
Max. 3·6. Min. 4·4.

		h	m
May	3	13	59
June	8	11	9
July	21	12	32
Aug.	26	9	42
Sept.	2	13	55
Oct.	8	11	5
Nov.	13	8	14
Dec.	19	5	24

ζ Geminorum. *
Max. 3·8. Min. 4·5.

		h	m
Jan.	16	8	1
	26	11	36
Feb.	5	15	11
March	28	9	3
April	7	12	38
Aug.	27	14	41
Oct.	27	12	8
Nov.	6	15	42
Dec.	27	9	35

S Cancri.
R.A. 8h 35m 56s
N.P.D. 70° 28′
Max. 8·0. Min. 10·5.

		h	m	s
Jan.	16	8	57	
Feb.	4	8	10	
	23	7	24	
Dec.	14	7	29	

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The observed times of Minima of short-period Variables require to be reduced to what they would have been at the earth's mean distance from the star, to render them comparable with each other, or with the above ephemerides. The following formulæ will supply these corrections, with their proper signs, in minutes of time, for each star; the earth's radius-vector and sun's longitude being denoted by R and ⊙ respectively:—

For Algol	$7^{\mathrm{m}}{\cdot}67\ R \sin (215^{\circ}\ 47' + \odot)$
λ Tauri	$8{\cdot}22\ R \sin (211\ 19 + \odot)$
δ Cephei	$4{\cdot}21\ R \sin (254\ 19 + \odot)$
η Aquilæ	$7{\cdot}72\ R \sin (331\ 31 + \odot)$
S Cancri	$8{\cdot}30\ R \sin (143\ 38 + \odot)$
ζ Geminorum ...	$8{\cdot}29\ R \sin (166\ 58 + \odot)$
β Lyræ	$4{\cdot}64\ R \sin (343\ \ 4 + \odot)$

On the Correction of Observations made with the Sextant. By W. H. Simms, Esq., communicated by William Simms, Esq.

The object of this communication is to demonstrate the practicability of correcting sextant observations for the instrumental error of excentricity;—an error, which probably exists in most sextants, and to such an amount that the maximum correction to an angle read from the arc is seldom less than 30″, and not uncommonly exceeds 1′.

The author commences by investigating the formula for the computation of the correction, the relative position of the centres of the index and arc being given. This relative position depends upon two constants, which enter into the formula: consequently, two or more absolute values of the correction being known, the constants can be determined. Such absolute values can be obtained in any number by comparing the results of observation of distances of well-known stars with their computed distances; or, at a place of which the latitude is known, by observation of meridian altitudes of similar objects. The latter method is undoubtedly the better and more convenient, and may be employed at a place of which the latitude is unknown, the latitude itself being introduced as a third unknown quantity into the equations resulting from the observations.

But, in order that this process may be applied with success, it is evidently necessary that the results of the observations should not be materially affected by any instrumental error other than excentricity. The author accordingly investigates the formulæ for the calculation of the corrections due to the remaining three principal errors to which the sextant is liable, viz. deviations of the planes of the index and horizon glasses, and of the optical axis, from their correct positions with respect to the plane of the instrument;—and shows that, if ordinary care be taken in the